NOTES

On the Establishment of the Oahu Research Center of the University of California

In recent years there has been a general recognition by many national governments that so-called basic or fundamental scientific research deserves financial support. Usually this recognition has been stimulated not so much by admiration for the scientists or a desire to increase the cultural heritage of mankind as by a hard-headed cost accounting applied to the history of technological progress in the past 25 years. In the long run it pays to support basic research. In the process of financing apparently useless projects the governments have, in spite of waste and some incompetence, received more than their money's worth in by-products. In the United States, naturally, the first example that comes to mind is the Manhattan Project and its subsequent development into the complicated investigations now carried on by the Atomic Energy Commission. One is apt to forget that the Federal Government, while making its major effort in the field of atomic physics, also supports a multitude of other research projects and that these are not always developmental in aim or technological in scope. While some governments, operating on the principle that he who pays the piper calls the tune, have tended to support basic researches only in their own laboratories, sometimes to the extent of starving the universities out of certain fields, in the United States there has been a consistent effort to avoid centralization by contracting for basic research with the institutions most competent to carry it out, namely, the universities and technological institutes.

The result has been, since the end of World War II, what is probably the greatest outpouring of the taxpayers' money into a purely intellectual venture that the world has seen. For 7 years the people of the United States have paid and have asked no questions. The administrators of the program, both civilian and, surprisingly enough, military, have recognized that it is almost impossible to assess the value of a basic research program in a decade. The results are often intangible, sometimes of a purely negative kind (as showing, for example, that a frontal attack on a given problem is unprofitable) or, in some cases, of value only in training the technologists and research workers of the future. Recently, however, there have been murmurs of discontent. As the tax bill grows larger and international tensions increase, three groups have criticized the most sensitive of the basic research programs: that supported by the Armed Services. First, the operating agencies of the Armed Forces, the men responsible for using weapons and planning battles, have felt that they have received practically no benefit from the basic research program, that progress is too slow in a period of war such as that in Korea, and that the money would be better spent on technological development the results of which can be foreseen now. Second, university administrators have complained that they are slowly being strangled by the red tape which is inevitably spun around research projects supported by the taxpayer and which increases every year. Complicated cost accounting and unimaginative auditing exasperate them and make them inclined to ask research workers in fundamental science to return to their ivory towers, however cramped these may now appear. Last, the research workers themselves are complaining. Some of them have been on contract work for 6 or 7 years, have obtained good results, and have written voluminous reports, as required by the university contract system. But these reports have been buried in official archives; often the operating arms of the services do not even know of their existence; sometimes the solution of a serious military problem already exists in embryo in the files of the agency most worried about it. No serious rift has developed yet, but, if the present tendencies persist, one can foresee the end of military support for basic research.

In many of the sciences this rift, no matter how wide it became, would not be serious for

the universities. Progress would continue at a slower pace, as it has for 4 centuries. In at least one field, however, a rift would be disastrous to the universities and, ultimately, to the Armed Services—the field of geophysics. In many parts of that science, research cannot even begin without access to the data, and the data are beyond the scope of any single university or congeries of universities to collect. Adequate observation depends on costly equipment, the employment of thousands of observers, and the facilities for collection and dissemination that only governments possess. On the other hand, government agencies tend to see this information in a very practical light. They may use it for many purposes, but with few exceptions these amount to attempts to solve *ad hoc* and day-to-day operating problems. Their methods of treatment tend to become stereotyped, and bureaucratic principles begin to override scientific principles in the handling of the data.

Against this background a very small but significant experiment in co-operation between the Air Force and a university is being established in the Hawaiian Islands. Three institutions are involved, and the research work about which the experiment is formed is chiefly in the field of tropical meteorology. Financial and physical support is given by Air Force Cambridge Research Laboratories, the project being monitored by the Geophysical Research Directorate of those laboratories. Air Weather Service, the operating agency of the Air Force most vitally interested in tropical meteorology, supplies both physical support and personnel. The University of California, through its Institute of Geophysics, supplies, under contract, civilian scientists and technicians and the overall direction to the research. The three groups have begun to work together at Wheeler Field on the island of Oahu, and full operation is expected in the very near future. Each agency has a different name for the project. That used by the civilian scientists working on the project and by the University of California is the Oahu Research Center. The general objectives of the work are, first, to continue the basic research work in tropical meteorology that has been conducted by the Institute of Geophysics at the University of California at Los Angeles during the past 5 years; second, to extend those researches to include the effects of mountainous islands on meteorological phenomena in the tropics; third, to continue the Institute's work on the macrophysics of tropical clouds, especially as they are affected by high relief; and, finally and perhaps most important, to translate with as little delay as possible the results of these investigations into technological procedures that can be used by Air Weather Service in any part of the tropics. The work has been split up and assigned to three divisions of the project called, respectively, the basic laboratory, the experimental laboratory, and the operational laboratory.

The basic laboratory will continue the investigations, begun in Los Angeles, of the general atmospheric circulation in the Pacific; of the origin, development, and movement of typhoons and hurricanes; and of the origin, development, and movement of upper-level tropical cyclones. It will extend its work to the monsoon countries, more particularly those of southeast Asia, and, in conjunction with the experimental laboratory, will attempt to develop an indirect aerology of the tropics.

The experimental laboratory will study the effects of mountainous islands on the fields of pressure, temperature, rainfall, and wind. It will undertake an investigation of orographic cloud. It will analyze many thousands of feet of movie film and stills of tropical clouds over the Central and South Pacific that have been accumulated during the past 2 years and will extend this photographic collection. Investigations of wind structure in the neighborhood of tropical clouds have been planned, and some theoretical work has already been done on this topic.

Both these laboratories will continue to publish their results in official reports and in scientific papers. However, the results will be available to the operational laboratory long before they reach the press. This laboratory will be built around a weather station of the type that has become standard in the Air Force. Current data, collected in the station by teletype, will be analyzed by both the civilian and military scientists day by day and under conditions as near those found in the field as possible. New techniques, suggested by the general researches of the project, will be developed, tested, and evaluated in this station. Any procedure found practicable and useful will be described in operating manuals suitable for Air Force use in the field. Finally, the film produced by the experimental laboratory will be surveyed and selections made by the operational laboratory for incorporation in training movies suitable for the Air Force.

Each scientist, whether military or civilian, has been assigned a part of this large field as a responsibility. To prevent over-specialization, however, and to ensure the free flow of information throughout the project, each scientist will be assisted by a research committee, whose task it will be to monitor the work and assist the responsible investigator in every way. Thus, each worker will have not only his responsible task but two committee tasks as well. In addition, operational problems will be explored in a daily map discussion, and scientific results will be reported in formal seminars, held every 2 weeks.

The danger to civilian scientists, inherent in an off-campus project of this kind, lies in the lack of outside criticism and stimulation. In Oahu this stimulation will come from the Weather Bureau and from meteorologists of the Pineapple Research Institute and the Air Weather Service units in the area. As soon as full operation of the unit is assured, distinguished scientists from outside Hawaii will be invited to visit the project and to consult on its problems.

Military direction of the project is in the hands of Lieutenant Colonel G. H. Duncan; the civilian group will be supervised by Professor C. E. Palmer of the Institute of Geophysics of the University of California. — *Clarence E. Palmer.*